APPENDIX BB
SUPPLEMENTAL PLANS SUPPORTING THE DIAMOND LAKE RESTORATION PROJECT (Alternatives 2, 3, & 5)

INTRODUCTION

This appendix contains three supplemental plans that respond to public comments on the DEIS:

I. Alternative 2, 3, & 5 Contingency Plan Version 1.0

II. The Diamond Lake Restoration Monitoring Plan Version 1.0

III. The Diamond Lake Tui Chub Reintroduction Prevention Plan Version 1.0

Plans were developed by and would be implemented through the cooperative efforts of the multiple agencies and entities of the Diamond Lake Work Group. It is expected that all of these plans would be updated periodically as new data, information, or funding becomes available. However, actions identified as "required" are considered to be critical to the project and would occur as a component of or follow up to project implementation. These plans are applicable to Alternatives 2, 3, and 5.

A monitoring plan for Alternative 4 is part of the project record, but is not replicated in this document because no public comments were received requesting additional details regarding monitoring of activities proposed under this alternative.

DIAMOND LAKE RESTORATION

SUPPLEMENTAL PLANS

VERSION 1.0

PREPARED IN SUPPORT OF THE DIAMOND LAKE RESTORATION

FINAL EIS

BY

THE DIAMOND LAKE WORK GROUP

OCTOBER 2004

I. ALTERNATIVE CONTINGENCY PLAN

INTRODUCTION

The purpose of this plan is to provide additional details regarding activities that the US Forest Service (USFS), Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Environmental Quality (ODEQ) and other partners on the Diamond Lake Work Group propose as a means of reducing rapid population increases of tui chub if/when their presence is documented in Diamond Lake in the years following a rotenone treatment under Alternatives 2, 3, and 5 in the FEIS. Implementation of this plan is, however, not expected to result in chub being totally eradicated from the lake or to serve as an effective population control if chub numbers reach high levels.

For analysis purposes, in response to public comments on the DEIS, the Forest Service and Cooperating Agencies agreed to assume implementation of this contingency plan as a reasonably foreseeable management activity that would be considered in cumulative effects analysis in the FEIS. For this analysis, it is assumed that a small population of tui chub would survive rotenone treatment or that tui chub would be reintroduced into the lake a short time following treatment. Required monitoring designed to facilitate early detection of tui chub is described in the monitoring plan. Economic estimates are based on the assumption that chub would be detected in 2011 and the contingency plan would be implemented annually from 2012-2016 or five years beyond the 7-year lifetime of the project.

REQUIRED ACTIONS FOR REDUCING CHUB POPULATION GROWTH IF CHUB REMAIN OR IF/WHEN CHUB ARE REINTRODUCED INTO DIAMOND LAKE

There are a number of activities that members of the Diamond Lake Work Group consider to be critical components or follow up actions associated with project implementation that would help reduce the high rate of chub population growth if/when chub presence is determined in the future. Barring unforeseen changes in management direction or policy and following completion of any additional required site-specific NEPA, the actions below would be accomplished at Diamond Lake following a rotenone treatment (Table 1).

Table 1. Required actions for reducing rate of tui chub population growth if/when presence at Diamond Lake reoccurs.

Action	Description	Estimated Timeframe	Assumptions & Cost Estimates for Effects Analysis
Mechanical Chub Removal: **Remove Reproductive Age Chub & Disrupt Spawning**	Tui chub removal techniques found to be the most effective at harvesting chub – nets, seines, traps, electrofishing, etc. would be utilized for approximately one month during the peak spawning period.	**Annually (June –July)**	**Assumptions**: * ODFW would research and acquire knowledge of chub removal during mechanical harvest prior to rotenone treatment. * Tui chub presence documented in 2011 during the lifetime of the project * Additional testing and refinement of chub removal techniques would occur in 2012. * From 2013 – 2016, mechanical removal would occur annually for approximately one month

Action	Description	Estimated Timeframe	Assumptions & Cost Estimates for Effects Analysis
			during the peak spawning period. **Cost Estimate:** 2012: $48,000 2013 – 2016: $48,000[1] per year for four years = $192, 000 **Total: $240,000**
***Chub Population Assessment:* Sample and Model Population Growth**	Annual sampling by ODFW crews will be implemented to determine tui chub population size, age-composition, and growth rate. Creel survey crews will sample stomach content of larger trout and assess predator effectiveness. Computer modeling of chub population will be completed annually and will be used to assist in determining appropriate level of mechanical effort.	**Annually**	**Assumptions**: * 2012 - 2016: One additional ODFW crew plus supplies would be needed to conduct this work for the five year period. **Cost Estimate:** 2012-2016: $17,000 per year[2] for five years = $85,000 **Total: $85,000**
Predacious Fish Stocking Plans	Annual review of fish stocking plans for Diamond Lake will be completed. If chub are determined to be present in the lake, immediate notice will be given to ODFW Fish Hatchery Production Program regarding potential stocking plan recommendations for modification of release strategies to include higher numbers and larger sizes of predacious fish. Predacious fish species that may be used include: rainbow and brown trout species.	**Annually**	**Assumptions**: * Knowledge gained from ongoing experimental stocking will be used to determine appropriate species and size class of predacious fish to stock. * 2012: If tui chub are detected during summer of 2011, stocking could not be changed this year because additional numbers of predacious fish would not be available from hatchery. *2013-2016: Size and number of predacious fish would double from stocking described in 2012- approximately 50,000 2 lb fish would be stocked annually. Cost of $6.40/fish. * To facilitate equitable economic comparison with Alternative 4, fish that would be stocked primarily to maintain the recreational fishery rather than to limit chub population growth will be included as follows: Alt 2 & 5: approximately 300,000 fingerlings annually for 5 years @ 7.6 cents/fish. Alt 3: 2012 would stock with

[1] Annual cost derived by reducing Rohleder estimate of $143,333 per year for commercial fishing by approximately one third. Same cost used for all action alternatives.
[2] In DEIS/FEIS, 6 years of this work was estimated at $100,000 or about $17,000/year and was included in the monitoring estimate for Alternative 4 throughout the lifetime of the project. Same cost used for all action alternatives.

Action	Description	Estimated Timeframe	Assumptions & Cost Estimates for Effects Analysis
			400,000 put and take rainbow and 24,000 legal sized EL rainbows and then in 2013 switch to large predacious fish- no additional put and takes would be stocked in 2013-2016.
			Cost Estimate: Predacious Alts 2,5 2012: $33,000 2013-20156: $320,000 per year for four years = $1,280,000 **Total: $1,313,000** Alts 2 & 5 Additional fish $22,800/year x 5 years = $114, 000 + large predators ($1,313,000) **Total Fish: $1,427,000** Alt 3 All fish 2012: $1,270,000 2013-2016: large predators for four years ($1,280,000) **Total Fish: $2,550,000**
TOTAL ESTIMATED COST OF CONTINGENCY PLAN (2011-2015)			**Alts 2 & 5 = $1,752,000** **Alt 3 = $2,875,000**

II. MONITORING PLAN

INTRODUCTION

A critical element in any successful adaptive management strategy is the implementation and interpretation of an effective, well designed monitoring plan. This is particularly true in a case where there is some uncertainty associated with the outcome of the proposed activities.

This plan is intended to ensure a consistent, thorough and repeatable strategy is used to document the effects of the proposed project. To accomplish this goal, a Monitoring Work Group, composed of agency and interested stakeholder group representatives, will be formed.

The plan is designed to alert responsible parties to changes and trends in important segments of the physical and biological systems operating in the project area. The plan sets the stage for the initial monitoring effort and recognizes the need for changes to the plan if monitoring results suggest additional parameters should be added to the monitoring effort.

This plan covers monitoring efforts from pre-treatment phase through post-treatment (a minimum duration of eight years (2004 through 2011). Based on results from this monitoring effort, the Monitoring Work Group will determine if an additional monitoring period is warranted.

All monitoring components detailed in this plan are considered to be high priority activities associated with implementation of project Alternatives 2, 3, or 5. If there is not sufficient funding available to complete the plan as described, frequency and/or duration of monitoring would be reduced rather than eliminating individual monitoring components. Partnering efforts are expected to maximize the efficiency and scope of proposed monitoring and reduce the likelihood that desired monitoring levels would be compromised due to lack of funding.

COMPONENTS OF THE PLAN

The following components are included in the monitoring plan:

1. ***Partnering efforts*.** Several ongoing monitoring efforts, such as actions resulting from the relicensing of the North Umpqua Hydro-electric Project, can provide data collection points, valuable information, and possible cost savings through volunteer efforts and sharing of staff resources.

    a. ***Monitoring Work Group***. The plan describes a work group composed of agency and interested stakeholder groups. The monitoring plan identifies the parties involved in the monitoring work group and establishes their respective roles and responsibilities.

2. ***Parameters or resources to be monitored***. The plan identifies what will be measured. The list of parameters is based in part on Eilers (2003a) and (2004).

3. ***Monitoring strategy***. The plan describes methods, sampling locations, duration, and frequency and reporting of sampling efforts. The plan also introduces a set of biological indices to help describe the health of the lake and surrounding systems.

    a. ***Methods:*** Sampling efforts will employ Standard Operating Procedures. These procedures are intended to ensure a consistent, repeatable effort.

    b. ***Locations*.** The plan identifies locations within or adjacent to Diamond Lake, Lake and Silent creeks; Lemolo Lake, and the North Umpqua River where monitoring efforts will be conducted. See Table 1 for specifics.

    c. ***Frequency, duration and reporting***. The plan describes the frequency of the monitoring effort and identifies time-frames within which results will be reported. The plan also identifies the duration of the monitoring effort. The duration of monitoring efforts is tied to the specific resources or parameters being measured and the reason for measuring them.

    d. ***Biological Indices*:** Monitoring results will be used to develop a set of biological indices, an indicator of lake health. This set of indices will aid decision makers in determining recovery of the lake's physical and biological attributes. These include, but are not limited to: pH, DO, nutrients, benthic invertebrates,

phytoplankton and zooplankton population levels. See Table 1 for specifics.

MONITORING OBJECTIVES

The U.S. Forest Service (USFS), in conjunction with the Oregon Department of Fish and Wildlife (ODFW) and Oregon Department of Environmental Quality (ODEQ), with support from the Monitoring Work Group, will be responsible for monitoring the water quality and the fishery quality, prior to, during, and after treatment of Diamond Lake and surrounding area. A variety of monitoring activities will be implemented in order to verify assumptions, evaluate project success, and formulate the appropriate lake management strategies. These activities include monitoring:

- Stream flow and water quality in Lake Creek; water quality in Diamond and Lemolo Lakes and the North Umpqua River;
- Fish species composition and presence in Diamond Lake,
- Phytoplankton, zooplankton and benthic invertebrate communities in Diamond Lake;
- Flora (macrophytes) in Diamond Lake; and potentially impacted flora, including wetlands in the surrounding area;
- Fauna in the areas immediately surrounding the lake;
- Ground water wells for the presence of rotenone and other organic chemicals (if the hydraulic gradient indicates flow is toward the summer home wells).

MONITORING WORK GROUP

The USFS, ODFW and ODEQ will work collaboratively in managing the restoration of Diamond Lake. ODFW and ODEQ will be the lead entities in defining the ranges and targets of biological and chemical indices used in determining management actions taken to ensure the "health" of the lake. The lead entities will continue to work within the Diamond Lake Work Group to effectively use resources available from other entities.

The Monitoring Work Group (MWG) will serve at the pleasure of the Diamond Lake Working Group. The MWG is responsible for ensuring the monitoring efforts outlined in this plan are carried out in a timely and responsive manner.

The MWG is composed of representatives from the USFS, U.S. Geological Survey, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, ODFW, ODEQ, Douglas County Public Health Department, Portland State University, Pacificorp, Oregon Lakes Association, and other interested parties.

The MWG will meet as needed, at the request of the Diamond Lake Working Group, to review methods and completion of monitoring results. Based on this review, the MWG will recommend changes regarding the ongoing monitoring effort, such as appropriate changes in monitoring protocol and duration of monitoring efforts. These recommendations will be forwarded to the Diamond Lake Working Group. Additionally, the MWG will review and comment on the biological and chemical indices and monitoring results used to gauge "health" of Diamond Lake (Eilers 2003a, 2004). These biological will be used to direct fish stocking levels including age class and numbers.

MONITORING PARAMETERS, LOCATION, FREQUENCY, AND TIMING

Proposed monitoring activities are described in some detail below. Additional details concerning these activities are provided in Table 1.

Surface Water Quality

- Diamond Lake: Diamond Lake water quality will be monitored throughout all phases of the project and seasonally for a minimum of five years post project. The monitoring locations, parameters and frequency of sample collection will vary over the different phases of the project and are detailed in Table 1.

- A water quality profile will be taken at one to two locations in Diamond Lake in June, July and August, from June 2005 through August 2011. Sample frequency will be 3-9 times annually. The required sample location will be at the north end of the lake at the deepest point (site identifier in the Diamond Lake Access [MS trademark] Database DLA). The profile will include pH, temperature, turbidity, conductivity, dissolved oxygen, oxidation/reduction potential, and secchi disk depth). Nutrients (organic, nitrate-nitrite, and ammonia nitrogen, and total and soluble reactive phosphorous), and major (for example calcium, magnesium, silica) ions will be collected from the surface, thermocline, and hypolimnium or bottom zone. An additional location (DLM) within dense aquatic macrophytes in Diamond Lake will also be monitoring for many of the same parameters (See Table 1).
- Ongoing monitoring for public health protection will continue according to established procedures from 2005-2011.
    - Phytoplankton: Phytoplankton analysis will include, identification composition and abundance of species, identification and quantification of algal toxins, and chlorophyll-a.
- Rotenone, rotenolone, and volatile organic compounds will be monitored following the rotenone treatment in 2006.

Biological Indices (Fish Stocking Indices/Water Quality)

- Diamond Lake: Information collected will provide the basis for a set of biological indices to aid in evaluating the health of the lake and determining the appropriate fish stocking levels to maintain adequate water quality conditions. A combination of biological and chemical indices will be used to guide and evaluate fish stocking. Detailed information on the indices that will guide fish stocking is included in Eilers (2003a) and Eilers (2004); these documents are incorporated by reference into this monitoring plan. Other water quality parameters are summarized in other sections of this document.

    - Zooplankton: Zooplankton analysis will include identification of species composition and abundance. Sampling will occur a minimum of 3-9 times annually under USFS contract and additional sampling will be completed by trained ODFW personnel. Annual sampling will occur for a minimum of five years post project.
    - Benthic Community: Benthos analysis will include species identification and determination of abundance. Sampling will occur a minimum of 3 times annually. Annual sampling will occur for a minimum of five years post project.

Lake Surface Elevation

- The lake elevation will be monitored continuously by the USGS through remote sensing application during all phases of the project. The operations coordinator will check data daily during the drawdown and treatment phases of the project.
- Lake elevation will be used to correct canal flow during the draw down phase which includes passing winter and spring runoff events down Lake Creek.
- The lake elevation would be a part of the safety contingency plan during canal closure.

Lake Sediment Safety

- Diamond Lake sediments will be monitored for levels of rotenone, rotenolone, and other organic chemicals present in the formulation following the rotenone treatment in 2006. Sediments will be sampled immediately following the rotenone application and continued until analysis determines that rotenone and other chemicals have dissipated. Sediments will be tested approximately once every two weeks.

Ground Water Quality

- The 16 ground water monitoring wells located around the perimeter of the Diamond Lake will be monitored weekly or as needed during the drawdown and treatment phases of the project. Monitoring for the presence of rotenone, rotenolone, and other volatile organic chemicals present in the formulation used will occur only if the hydraulic gradient indicates that ground water flow is toward the summer cabin wells during the treatment phase.

Lake Creek Stream flow

- Stream flow in Lake Creek and Canal: Stream flow in Lake Creek and/or the canal will be monitored throughout all phases of project implementation and will continue post project.
- Monitoring will be conducted via an existing U.S. Geological Survey (USGS) continuous monitoring stream gaging station, located within one quarter mile of the lake outlet. Stream flow data will be continuously monitored via the station, prior to lowering the lake, during the draw down phase until outlet channel dries at the gaging station, and post implementation.
- Additionally, a gaging station will be constructed in the canal to continuously monitor stream flow through the canal.
- An operations coordinator will evaluate incoming data daily and canal flow will be regulated as needed in order to maintain bankfull flow, pass winter and stream runoff events, and adjust flow if downstream responses require.
    - Visual observations of the flow in the canal and downstream in Lake Creek would also be made routinely and during winter and spring runoff events.

Lake Creek Channel Morphology

- Monitoring to detect potential changes in channel morphology in response to the drawdown would occur at multiple locations on Lake Creek. Activities would occur on a variable basis prior to, during, and following the drawdown.
- In 2004, photo sites were established and physical measurements taken at three landslide features on Lake Creek considered the most sensitive to fluvial erosion (Map in Geology Report). Follow-up monitoring of these sites would occur during and after the draw down.

- During the draw down phase, when the flow in Lake Creek would be at its highest (winter and spring runoff events), visual observations of channel morphology response would be conducted and documented at potentially sensitive areas of the stream channel (Road 4700-710 crossing, Highway 138 crossings of Lake Creek and the embankment at Pit Lake #1). Frequency of visits to these sites would be determined by the duration and intensity of the runoff events.
- Findings of resources at risk would immediately activate actions to avoid potential channel impacts.
- In 2004, a cross-sectional station was established near Pit Lake No.1. Data collection will be repeated following the drawdown

Lake Creek Water Quality

- Water quality samples would be taken at multiple locations on Lake Creek. Sampling would include temperature, pH, turbidity, DO, conductivity, nutrients, and algae and rotenone presence.
- Sampling would be conducted on a variable basis from 2005-2010 (See Table 1).

Downstream Water Quality

Lemolo and Toketee Reservoirs and the North Umpqua River:

- Water quality will be monitored in Lemolo and Toketee Reservoirs by collecting data (pH, DO, Chl-a,Secchi, phytoplankton, zooplankton, major ions and nutrients) a minimum of once in the summer following the following the drawdown, following a rotenone treatment; and in 2010.
- Water quality will be monitored at multiple locations on the North Umpqua River during all phases of the project. Frequency, locations, and parameters are detailed in Table 1.

Fish Community/Recreational Fishery

- Monitoring of fish populations in Diamond Lake, including species identification, volume, size and annual harvest rates would begin with the mechanical harvest phase of the project and continue annually for a minimum of five years post project.
- Fish Health: Trout condition factor, growth rate, and survival rate will be monitored annually and used as contributing indices that guide fish stocking (Eilers 2004).
- Fish Biomass: Monitoring of biomass and nutrient removal will occur during pre and post rotenone treatment mechanical harvest via calculating:
    - Estimates of initial biomass and biomass removed by mechanical fish harvest.
    - Sampling of fish removed to estimate nitrogen and phosphorous content used to calculate nutrient amount removed.
- Tui Chub Presence: The presence of tui chub will be monitored throughout all phases of the project. Annual monitoring activities and schedules are described in detail under the tui chub contingency plan in this document.
- Creel Surveys: Creel surveys will be conducted weekly from April to October on an annual basis as a means of documenting potential changes in recreational fishing s at Diamond Lake.

Aquatic Macrophyte Community

- Aquatic macrophytes in Diamond Lake will be monitored seasonally on an annual basis from 2005-2010. Analysis will include species identification and determination of abundance and distribution.

Flora and Fauna

- Monitoring of the flora and fauna around Diamond Lake will consist of evaluating osprey and bald eagle reproductive success (monitoring of bald eagle is ongoing as part of other regional efforts), amphibian populations, Lincoln's sparrows, the Crater Lake tightcoil snail, and goblin's gold. Frequency and duration of monitoring varies by species (see Table 1). In addition, monitoring of wetland vegetation around the south shore will be conducted to determine the impacts of dewatering on the wetlands. The lake will be monitored annually in August for invasive aquatic plant species.

Weather

- Weather monitoring will be conducted in all phases of the restoration project via downloading of data at the existing Diamond Lake weather station.

Visitor Use and Satisfaction

- A survey measuring visitor use and satisfaction will be conducted within three years of lake treatment. Visitor satisfaction results will be compared to survey results from 2001 and 2003. By comparing survey results, a measure of visitor satisfaction, public support and expectations will allow decision makers to determine if aesthetic and recreational objectives were met.

Cultural Resources

- Ground disturbing activities within areas that have a high probability of cultural resource occurrence will be monitoring during and/or after project implementation. Appropriate measures to mitigate any adverse effects to cultural resources will be implemented as needed.

Best Management Practices Checklist

- Completion of a Best Management Practices (BMPs) checklist is a monitoring requirement under the 1990 Umpqua National Forest Land and Resource Management Plan. This checklist is included as Appendix B of the EIS and will be used to ensure compliance with state requirements in accordance with the Clean Water Act. BMPs are incorporated by reference into the monitoring plan and a completed checklist will be included in post project monitoring reports.

METHODS

Standard Operating Procedures for the analysis of in-situ water quality, nutrients and major ions, turbidity, phytoplankton, zooplankton, fish, and benthic community are described in "Standard Methods for the Examination of Water and Wastewater, 20th Edition" (Clesceri, Greenberg, and Eaton, 1998).

Macrophytes would be monitored using the protocol developed by the Center for Lakes and Reservoirs at Portland State University.

The identification of fish species and estimates of abundance, as well as creel surveys will follow established ODFW procedures. Biological indices, used to guide fish stocking will follow procedures identified in Eilers (2004).

Wildlife biologist and botanist from the U.S. Forest Service will monitor the flora and fauna using various established protocols. The vegetation monitoring will be based on established methods as outlined by Elzinga, Salzer, and Willoughby (1998).

Ground water level elevation measurements will be collected using the U.S. EPA's standard procedures described the "Ground Water Technical Enforcement Guidance Document" (EPA-OSWER-9950.1, Sept. 1986)

Rotenone sampling and analysis will follow the procedures outlined in the Rotenone Use in Fisheries Management: Administrative and Technical Guidelines Manual (Finlayson et al. 2000).

APPROXIMATE MONITORING SCHEDULE AND SUMMARY OF MONITORING ACTIVITIES

Monitoring activities will correspond to different phases of the Diamond Lake Restoration project. The approximate schedule for project activities and corresponding monitoring are as follows: 2004 and 2005 pretreatment baseline; May 2005, canal reconstruction; September 2005 initiation of lake drawdown; September 2006, rotenone treatment; November 2007 through July 2008, lake refill; and 2007-2010[3], post treatment phase. Proposed monitoring is summarized in Table 1 below. In general, the monitoring activities include:

[3] Monitoring activities beyond 2010 will be established in subsequent versions of this monitoring plan.

Table 1. Proposed monitoring activities in association with the Diamond Lake Restoration Project (Alternatives 2,3, & 5).

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
Public Health Monitoring	**Surface Phytoplankton and Toxin**	**Diamond Lake** Lake Middle DLA, North Dock DND, South Ramp DSR surface phytoplankton and toxin[4]	**- All phases**	**Annual Basis: 2005-2011** Weekly sampling of DLA May through September, other sites and toxin according to algae density (no sample in 2007 during rotenone treatment)	**USFS**
Diamond Lake Water Quality	pH, DO, Chl-a,Secchi, phytoplankton id & biovolume, zooplankton, major ions (occasional) and nutrients	**Diamond Lake** DLA Lake Middle & DLM	**- All phases**	**Annual Basis: 2005-2011** Sampling 3-9 times annually: April, May, June 1, June 15, July 1, July 15, August 1, August 15, and September.	**USFS/ODEQ**
**********					
Fish Stocking Indices (Eilers 2004) **See Fish Stocking Section Below for Additional Comments**	**Lake Health[5]** Benthic Community Edible Zooplankton Secchi Disk Chlorophyll-*a* **Fish Health[6]** Condition Factor Growth Rate Survival Rate	**Diamond Lake**	**- All phases**	**Annual Basis: 2004-2011** **Sampling minimum 3 times annually: May, August, and October.**	**ODFW/ODEQ**
**********					
Lake Surface Elevation	**Water Level**	**Diamond Lake**	**- Drawdown** **- Treatment**	**Continuous Basis: 2000-2010**	**USFS**

[4] DLA, DLM, DND, DSR, LCO, SIB and SHC are site identification codes for water quality, biological, streamflow, climatic and other data in the Diamond Lake Access Database Version 4.0, J. Eilers Maxdepth Aquatics, 2004 for Umpqua National Forest (see Figure 1).
[5] Eilers 2004. An Ecologically-Based Index for Guiding Salmonid Decision in Diamond Lake. In Press
[6] Loomis et al, ODFW. 2004. Fish Health Indices for Diamond Lake, 1955-2004. In Press

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
		Install a USGS Gage	**- Refill**	USGS data available continuously. Operations coordinator check data daily during drawdown and adjust outflow accordingly. As needed during other phases.	
Lake Water Safety (Rotenone)	**Piscicide** Rotenone, Rotenolone, & Inert Ingredient Presence	**Diamond Lake** Surface Water Sediments	**- Post Treatment**	**Variable Basis: 2006** Weekly sampling of water column; once every two weeks for sediments	**ODFW**
Ground Water Condition	**Water Level** Utilize existing monitoring wells to determine potential for drying of summerhome wells	**Diamond Lake** 16 mapped wells (non summerhome wells optional)	**- Drawdown** **- Treatment**	**Variable Basis: 2005-2006** Weekly sampling or as needed	**USFS**
	Piscicide Rotenone, Rotenolone, & Inert Ingredient Presence	**Diamond Lake** 16 mapped wells (non summerhome wells optional)	**- Treatment** **- Post Treatment**	**Variable Basis: 2006** Weekly sampling or as needed	**ODFW**
Lake Creek Condition	**Streamflow & Stream Temperature**	**Lake Creek & Canal** Existing USGS Stream Gage #14312500 in Lake Creek near Diamond Lake/Lake Creek Outlet Install a USGS Gage #14312501 and install on Diamond Lake Canal	**- Drawdown** **- Treatment** **- Refill**	**Continuous Basis: 2000-2010** USGS data available continuously. Operations coordinator check data daily during drawdown and adjust outflow accordingly. As needed during other phases.	**USFS**
	Channel Morphology	**Lake Creek**	**- Predrawdown** **- Post project**	**Variable Basis: 2004-2007**	**USFS**

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
	- Channel Cross Section Baseline measured in 2004	Pit Lake # 1 site		Data collected once predrawdown (2004) and once post-project (2007)	
	- Erosion Photo Points Data collected in 2004	3 Mapped Landsite Sites – Geology Report	**- Predrawdown** **- Post project**	**Variable Basis: 2004-2007** Data collected once predrawdown (2004) and once post-project (2007)	**USFS**
	- Visual Observation (Flood Patrol) Protect road crossings & stability of embankment on Pit Lake #1 (i.e. prevent diversion of Lake Creek into Pit Lake)	Road 710 and Highway 138 culverts Pit Lake #1	**- Drawdown**	**Weekly Basis: 2005-2006** Weekly observations or as needed during high flow storm events	**USFS**
	Water Quality **- Chemistry** Install a USGS Gage #14312501 pH, DO, Temperature, Turbidity, Sp Conductance	Lake Creek just above Highway 138 (303d water quality limited reach for temperature)	**- Drawdown** **- Treatment** **- Refill**	**Continuous Basis: 2006-2007** USGS data available continuously. ODEQ use data to monitor 303d compliance	**USFS/ODFW/ODEQ**
	Water Quality **Nutrients** nitrogen TKN, NO3 + NO2, NH3, and phosphorous TP, PO4,	Lake Creek above the 2610-400 Road (LAKEM station)	**- Post drawdown, water pass through phase** **- Post project**	**Variable Basis: 2006-2010** Collect grab samples once in late summer 2006, 2007, and 2010	**USFS**
	Water Quality - Rotenone, Rotenolone, & Inert Ingredient Presence	Lake Creek above the 2610-400 Road (LAKEM station)	**- Post treatment**	**Single Sample: 2006** Following rotenone treatment	**ODFW**
Lemolo Lake & Toketee Lake Condition	**Water Quality** pH, DO, Chl-a,Secchi, phytoplankton id &	Lemolo Lake Middle Toketee Lake Middle	**- Post drawdown, water pass through phase** **- Post treatment**	**Variable Basis: 2006 – 2010** Sample a minimum of once in the summer:	**USFS/ODEQ**

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
	biovolume, zooplankton, major ions and nutrients			following the drawdown, following a rotenone treatment; and in 2010.	
North Umpqua River Condition Monitoring plan will use water quality monitoring data collected and financed under FERC license by PacifCorp and USFS/BLM from two additional downstream locations: Existing gage stations at North Umpqua at Soda Springs (14316460) and North Umpqua above Rock Creek (14317450) Monitoring plan will use stream flow data collected and financed under FERC license by PacifCorp from 12 additional downstream stream and canal gages	**Water Quality** **- Chemistry** Install two USGS stations to measure pH, DO, Temperature, Turbidity, Sp Conductance,	Full flow (303d) reach above Toketee Reservoir North Umpqua above Copeland Creek (use existing stream gage 14316500)	**- Drawdown** **- Treatment** **- Refill**	**Continuous Basis: 2006-2007** USGS data available continuously. ODEQ would use data to monitor 303d compliance	**USFS/ODFW/ODEQ**
	Water Quality **Nutrients** nitrogen TKN, NO3 + NO2, NH3, and phosphorous TP, PO4,	Full flow (303d) reach above Toketee Reservoir North Umpqua above Copeland Creek (use existing stream gage 14316500) Existing stations: at North Umpqua at Soda Springs (14316460) and North Umpqua above Rock Creek (14317450)	**- Drawdown** **Post drawdown, water pass through phase** **- Post project**	**Variable Basis: 2006-2010** Collect grab samples once in late summer 2006, 2007, and 2010 at all four stations.	**USFS**
North Umpqua Water Quality & Algal Conditions (long-term)	**Periphyton (attached algae),**	33 sites (duplicate Anderson and Carpenter 1998)	**Predrawdown** **-post project**	**Variable Basis: 2005-2010** Minimum of one sampling effort in July of 2005 &2010	**USFS/ODEQ**
Fish Community Changes	**Fish Biomass** Estimate amount of fish biomass (and correlating nutrients) removed from lake during pre and post	**Diamond Lake**	**-Pre-rotenone treatment** **- Post rotenone treatment**	**Variable Basis: 2005-2006** Data collected throughout the mechanical harvest and recovery periods prior	**ODFW**

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
	rotenone mechanical fish harvest efforts.			to and immediately following the rotenone treatment	
	Tui Chub Presence Sampling to provide early detection of tui chub and other invasive fish species	**Diamond Lake**	**- Post Treatment** **- Post Project**	**Annual Basis: 2006-2010+** Multiple sampling efforts immediately following rotenone treatment. Extensive[7] sampling during tui chub spawning season on an annual basis.	**ODFW**
Recreational Fishery Changes Other aspects of the recreational fishery are already addressed under "Fish Health"	**Creel Surveys**	**Diamond Lake**	**All phases**	**Weekly Basis: 2005-2010** Creel surveys will be conducted weekly from April to October annually.	**ODFW**
Lake Macrophyte Changes	**Macrophyte Community Composition and Distribution** Detect changes in aquatic macrophyte community and provide for early detection of aquatic nuisance species	**Diamond Lake**	**All phases**	**Annual Basis: 2005-2010** Minimum of one sampling effort per year beginning in the year prior to lake drawdown.	**USFS**
Wetland Flora Changes	**Vegetation Community Composition and Distribution**	**Silent Creek Wetlands**	**All phases**	**Annual Basis: 2004-2010** Annual data collection in July and August.	**USFS**

[7] ODFW will complete two primary activities designed to facilitate early detection of tui chub: 1) **Conduct fish netting operations during peak months of chub spawning activity -** ODFW personnel will set nets on a regular basis annually from June-July in known areas of chub spawning. If any chub are observed, immediate action will be taken to increase the numbers and sites of netting operations to remove chub. Other mechanical treatments will be used when feasible to limit initial population growth potential**;** 2) **Conduct visual surveys of shoreline areas for chub population presence -** ODFW personnel and volunteers will conduct shoreline surveys on a regular basis annually during June- August to document any presence of fish less than 4 inches. Follow-up actions by ODFW will be taken immediately to determine actual species, numbers of smaller fish, and presence in other areas. Immediate action will be taken to increase monitoring and mechanical treatment if chub are determined to be present. Follow up actions are detailed in the contingency plan section of this document.

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
	Photo points and vegetation sampling plots to detect potential impacts of drawdown, Goblin's gold species specific monitoring				
Fauna Changes	Bald Eagles and Osprey Reproductive Success	**Diamond Lake**	**All phases**	**Annual Basis: 2004-2010** Multiple visits annually to determine nesting status and reproductive success. Monitoring will continue for two years following restoration of the fish prey base.	**USFS/ODFW**
	Amphibian Community	**Diamond, Horse, and Teal Lakes**	**Post-project**	**Annual Basis: 2007-2010** Minimum of one survey effort annually for three years following rotenone treatment	**USFS/ODFW**
	Crater Lake tightcoil Snail Presence	**Known sites on Lake Creek**	**- Pre drawdown - Post drawdown**	**Variable Basis: 2005-2007** Data collected once predrawdown (2005) and once post-project (2006 or 2007)	**USFS**
	Lincoln's Sparrow Presence	**Silent Creek Wetlands**	**- Pre drawdown - Post drawdown**	**Variable Basis: 2005-2007** Data collected once predrawdown (2005) and once post-project (2006 or 2007)	**USFS**
Weather/Climate	**Wind direction and speed, temperature, bar pressure, solar radiation, precipitation**	**Diamond Lake Existing Weather Station**	**All phases**	**Variable Basis: 2005-2010** Data available on a continuous basis. USFS et al. will down load and utilize on an as needed basis	**USFS**

MONITORING COMPONENT	PARAMETER	LOCATION	PROJECT IMPLEMENTATION PHASE	FREQUENCY & APPROXIMATE TIME FRAME	RESPONSIBLE PARTY
Recreational Use Changes	**Visitor Use and Satisfaction Survey** Comparison to pre project survey	**Diamond Lake**	**Post-project**	**Single Event: 2009** Visitor use survey would be conducted approximately three years following the rotenone treatment.	**USFS**
Cultural Resource Protection	**Historic Feature Condition** Canal and canal control structures	**Lake Creek Canal**	**- During or following canal reconstruction**	**Single Event: 2005** Qualified historian will monitor during or following canal reconstruction to determine appropriate measures for protecting historic features.	**USFS**
Monitoring Activities Below This Line Are Desirable, But Not Required Actions Associated With This Project					
Water Inflow	**Water Volume** Operation of gaging stations to monitoring water inflow into Diamond Lake	**Silent Creek** USGS 14312400 Silent Creek near Diamond Lake (presently discontinued) SIB Silent Creek Bridge **Short Creek** (USGS 14312450 Short Creek near Diamond Lake) SHC Short Creek at mouth	**All phases**	**Continuous Basis: 2005-2008** USGS data available continuously. Use as needed.	**USFS**
Stream Macroinvertebrates Changes (Ongoing Long-term Monitoring on the Umpqua National Forest)	**Macroinvertebrate Community Composition**	**Lake Creek & North Umpqua River** Riffle, margin and detritus sites on Lake Creek, North Umpqua River above Lemolo 2 Powerhouse, Copeland Creek, and Rock Creek	**- Pre project** **- Post project**	**Variable Basis: 2006-2010** Sampling recommended to occur in September 2006, 2007, 2008 and 2010	

FISH STOCKING: MONITORING AND ADAPTIVE MANAGEMENT

As described in the body of the FEIS, ODFW's actual fish stocking levels for all alternatives will comply with nutrient allocations documented in the final TMDL. Within the confines of existing scientific knowledge, this legal obligation ensures that future fish stocking at Diamond Lake will not be managed to the detriment of water quality. ODEQ and ODFW are currently working with professional hydrologist, Joe Eilers, Maxdepth Aquatics, Inc. to establish thresholds and corresponding management responses relevant to the following parameters that are considered to be the best indicators of the lake's response to fish stocking: benthic community size and species composition, percent edible zooplankton, sechhi disk depths, and chlorophyll-*a* levels. At the time of this writing, ODFW has financed and completed two training sessions by Eilers in the collection of this data.

Monitoring data will be collected three times annually in May, August and October. Data will be analyzed and incorporated into a report that will be available to the public. This data in combination with fish health indices[8] (Loomis et al. 2004, In press)and other water quality monitoring data (collected by the USFS) will be analyzed and used by ODFW to make appropriate adjustments in the following year's fish stocking levels and strategy. Eilers 2004 (in press) will make recommendations on thresholds and appropriate management responses. ODEQ will review and finalize these recommendations and incorporate them into the final TMDL for Diamond Lake.

REPORTING

Documentation of implementation activities will be collected during all phases of the project. Detailed information such as contractor names and dates for facility construction (i.e. canal, temporary bridges, and Resort cleanup activities); permit documentation; and funding sources will be collected and compiled. Similarly, documentation related to fish salvage, rotenone application, water management, etc. will be collected and assembled into an implementation report. A documentary video of the rotenone application process is recommended. Completion of the BMP checklist will be the responsibility of the USFS and it will be incorporated as a component of the Implementation Report. Completion of an Implementation Report is the responsibility of the MWG. This report will be posted on the Umpqua National Forest, ODFW, and ODEQ websites.

Monitoring results for activities described in Table 1 will be documented in an annual monitoring report assembled by the MWG and posted on the USFS, ODFW, and ODEQ websites. An interim report on the fish stocking indices (benthic community, edible zooplankton, secchi disk, chlorophyll-a) will be completed and made available to the public prior to annual fish stocking. This interim report is also the responsibility of the MWG.

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[8] ODFW is currently finalizing a document that describes the indices that will be used to assess fish health in Diamond Lake and contribute to fish stocking strategy refinement.

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III. TUI CHUB REINTRODUCTION PREVENTION PLAN

INTRODUCTION

The purpose of this plan is to provide additional details regarding activities that the US Forest Service (USFS), Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Environmental Quality (ODEQ) and other partners on the Diamond Lake Work Group propose as a means of reducing the likelihood of human-caused reintroduction of tui chub in Diamond Lake in the years following a rotenone treatment under the preferred alternative in the FEIS. Implementation of this plan is also expected to reduce the likelihood of human – caused introductions of other invasive species to the lake (i.e., noxious weeds, zebra mussels, and other nuisance fish species).

REQUIRED ACTIONS FOR REDUCING REINTRODUCTION POTENTIAL

There are a number of activities that members of the Diamond Lake Work Group consider to be critical components or follow up actions associated with project implementation that would help reduce the likelihood of unwanted introductions. Barring unforeseen changes in management direction or policy and following completion of any additional required site-specific NEPA, the actions below would be accomplished at Diamond Lake in the decade following a rotenone treatment (Table 1).

Table 1. Required actions for reducing tui chub reintroduction potential at Diamond Lake.

Action	Description	Estimated Timeframe	Responsible Agency(s) (Comments)
Boat Cleaning and Inspection Stations	Two boat cleaning stations would be constructed at Diamond Lake; near the north and south entrances at appropriate locations between highways and boat ramps. Trained personnel at each station would distribute educational materials, inspect boats for presence of invasive species, and assist the public in thorough boat cleaning.	Begin 2005-2007 (Requires site-specific NEPA)	**USFS** A request for $150,000 for boat washing stations was submitted to the Oregon State Marine Board for consideration in September 2004.
Interpretive Brochures	Interpretive brochures documenting the ecological and economic consequences of tui chub reintroduction (and other invasive species) would be created. Brochures would be distributed to the public during the sales of fishing licenses throughout the state; during the collection of campground fees at Diamond Lake and Lemolo Lake; at all Forest Service and ODFW offices, and all area visitor centers.	Begin 2006-2007	**ODFW & USFS**
Interpretive Signs	Interpretive signs documenting the ecological and economic consequences of tui chub reintroduction (and other invasive species) would be created and installed at all Diamond Lake and Lemolo Lake boat ramps.	Begin 2006-2007	**ODFW**

OTHER DESIRED ACTIONS FOR REDUCING REINTRODUCTION POTENTIAL

There are other activities that members of the Diamond Lake Work Group consider to be desirable follow up actions associated with project implementation. However, these actions require new legislation, changes in policy or regulation, or would be contingent on additional available funding in order to implement. Thus, activities described in Table 2 are desired actions, that would further reduce the likelihood of tui chub reintroduction, but it is currently uncertain whether or not they would actually occur.

Table 2. Desired optional actions for further reducing tui chub reintroduction potential at Diamond Lake.

Action	Description	Required Process	Responsible Agency(s)
Increased Fines for the Illegal Transport or Possession of Tui Chub	Monetary fines and other legal penalties would be substantially increased for tui chub possession and transport violations.	State Legislative Action	**ODFW**

Action	Description	Required Process	Responsible Agency(s)
Required Boat Cleaning Prior to Launching at Diamond Lake	A requirement to complete boat cleaning and inspection prior to launching a boat in Diamond Lake would be established.	Environmental Assessment and approval of a policy directive.	**USFS**
Required Angler Stamp	An "angler stamp" would be required for all persons wishing to fish at Diamond Lake. Stamps would be free to the public (or low cost) and would come with an educational brochure documenting the ecological and economic consequences of tui chub reintroduction (and other invasive species).	State Legislative Action	**DL WORKGROUP**
Cooperative Enforcement Plan	ODFW will meet with the Oregon State Police Fish and Wildlife Division (OSP) to establish cooperative enforcement priorities for Diamond Lake related to resource management, social considerations, and administration. An Action Plan specific to lowering the risk of reintroduction of chub and other invasive species will be adopted for Diamond Lake and other nearby lakes.	ODFW Directive	**ODFW, OSP, USFS**
Diamond Lake Council (or Friends of DL)	ODFW will initiate a formation of a watershed council approach to developing and completing actions that will significantly lower the risk of a of an illegal introduction of chub and other invasive species into the Diamond Lake area. This Council will use collaborative efforts to initiate education actions, help with monitoring plan activities, encourage compliance with voluntary check-ins and inspections of boats, seek funding sources for short and long-term projects, including a science and interpretive facility onsite to display education and information related to problems with illegally introduced species.	ODFW Directive	**DL WORKGROUP**

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